Remarks

Favorable consideration and allowance of the subject application are respectfully solicited.

Claims 1 and 3, 5, 7, and 8 remain pending in the application, with Claim 1 being independent. Claims 4 and 6 have been cancelled without prejudice. Claims 1, 3, 5, and 7 have been amended herein.

Claim 1 is directed to a color liquid crystal display device. The device includes a liquid crystal display part, and as amended, includes light sources for irradiating the liquid crystal display part with lights of three primary colors sequentially or simultaneously, the device displaying a frame picture by sequential fields of three primary color pictures and a field of a white picture in the liquid crystal display part. As amended, Claim 1 additionally includes a circuit for determining a minimum level of brightness among three color signals in a pixel, a circuit for subtracting the minimum level from the level of brightness of the three primary color signals to create display signals for respective primary color fields, a circuit for determining a maximum among minimum levels of brightness of all pixels in a frame and multiplying a constant to the minimum levels of each pixel to create a display signal in the white field, the constant being determined by the maximum and a weight factor of the white field relative to the primary color fields, and a circuit for modulating the brightness of the primary color light source in the white field according to the constant.

A brief description of the present invention by way of example Figures A to D shown in the attached appendix is in order. Of course, the claims are not intended to be

limited by these examples. In example Fig. A, a minimum level of brightness among the three color signals is shown. For Fig. A, the minimum level corresponds to the primary color blue. The minimum values are determined for all pixels (as shown in Fig. B) and among them is a maximum, which is the minimum level of brightness. This maximum is shown by the "X" in Fig. B.

After the minimum levels are determined for all pixels, each pixel is multiplied by a constant to give the signal of the white field. The white field signals are then renormalized as shown in Fig. C. This renormalization increases the transmittance of the liquid crystal.

The brightness of the light source is then reduced to give the appropriate level of brightness, as shown in Fig. D, which is a time chart of the transmittance of a pixel of the liquid crystal device and the light source brightness of the primary colors R, G and B. In the example depicted in Fig. D, the liquid crystal device transmits light in R and G fields, but not in the B field. In the white (W) field, the transmittance is modified from Wmin to W. The light sources fully irradiate each primary color field, which reduces the brightness of the white field.

The second conventional method disclosed in Applicants' specification is directed to a method in which four fields, including three fields of primary R, G, and B colors and a white (W) field are successively driven. In this second conventional method, the signals of R, G, and B colors and a synchronous signal V_{sync} outputted from the A/D conversion circuits 11 to 13 are supplied to the minimum value detection circuit 14, the minimum value detection circuit 14 compares the inputted R, G, and B digital signals, and

supplies the minimum value thereof to the P/S conversion circuit 20 as the W signal. Thus, in contrast to the present invention, the second conventional method does not, at least, teach or suggest multiplying a constant to the minimum levels of each pixel to create a display signal in the white field, a feature recited in Claim 1.

Thus, the second conventional method fails to disclose or suggest an important feature of the present invention recited in Claim 1.

U.S. Patent No. 6,392,717 issued to Kunzman is directed to a display system using red, green, blue, and white light. As previously discussed in Applicants' Amendment After Final Rejection, as understood by Applicants, Kunzman arranges a white field (or white pixel) so as to increase the brightness of an image and determines a white signal from red, green and blue so as not to generate wash-out of a high brightness region. Kunzman teaches making a brightness signal of the white field from a minimum value W of RGB (i.e., min (R, G, B)).

When W exceeds a certain value Cmax, the signals actually applied to the pixel in Kunzman are signals having values obtained by adding certain values to the original RGB signals, respectively, and brightness as the amount of Cmax is compensated by lighting of the white field, whereby the brightness of an image can increase and the wash-out can be avoided in the level of high brightness. These values include the following:

$$R' = R+g(W-Cmax)$$

$$G' = G+g(W-Cmax)$$

$$B' = B+g(W-Cmax).$$

Applicants submit that Cmax is defined as the maximum value of each color. Although the contents of Cmax are not clear, Applicants believe that Cmax corresponds to the brightness level of the white field.

Applicants submit that according to the present invention, the maximum among the minimum levels of brightness of all pixels in a frame is not the same as the Cmax taught by Kunzman, as suggested by the Examiner at page 2 of the Advisory Action. Referring again to example of Figure B of the Appendix to this Preliminary Amendment, Wmin(X) = Wmax. Kunzman, in contrast discloses at column 4, line 17 that W=min(R,G,B) and at column 4 line 33 that W may be greater than or equal to Cmax. Thus, Cmax and W may be different values, which is in contrast to Applicants' claimed invention.

Accordingly, although Kunzman may disclose determining the minimum value of RGB, the reference fails to teach or suggest determining a maximum among minimum levels of brightness of all pixels in a frame and multiplying a constant to the minimum levels of each pixel to create a display signal in the white field, the constant being determined by the maximum and a weight factor of the white field relative to primary color fields, as in the present invention. Additionally, although Kunzman can determine the signal level of each pixel, Kunzman can never modulate or set the brightness of the light source corresponding to the brightness level of an image because the brightness of the light source in Kunzman is determined by the transmittance of a rotating wheel.

In the Advisory Action, the Examiner suggested that Kunzman teaches to set the brightness of the light source in the white field during calibration as the maximum

value multiplied by the proportion value. However, Fig. 6 and its corresponding text in Kunzman relates to calibration of the brightness of a light source. The brightness is measured at 64 and on the basis of the result the parameters of the color wheel are determined. As such, Kunzman does not teach or suggest modulating the brightness of the primary color light source in the white field according to the constant, where the constant is determined by the maximum and a weight factor of the white field relative to the primary color fields.

Thus, Kunzman fails to remedy the deficiencies of the conventional system noted above with respect to independent Claim 1.

Applicants submit that this application is in condition for allowance, and a Notice of Allowability is respectfully requested.

Applicants' undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should continue to be directed to our below-listed address.

Respectfully submitted,

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APPENDIX

Fig. A

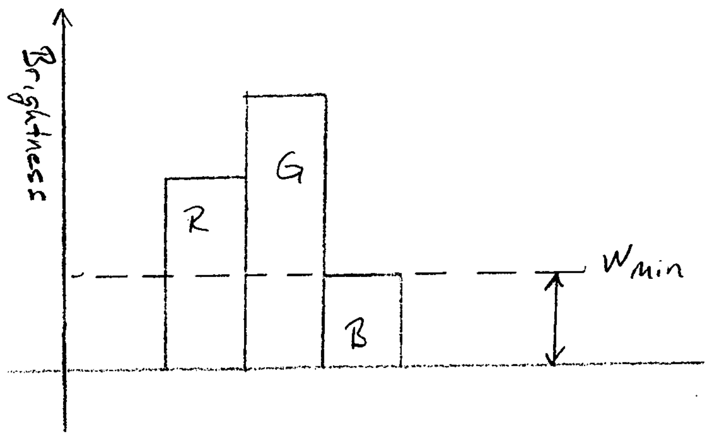


Fig. B

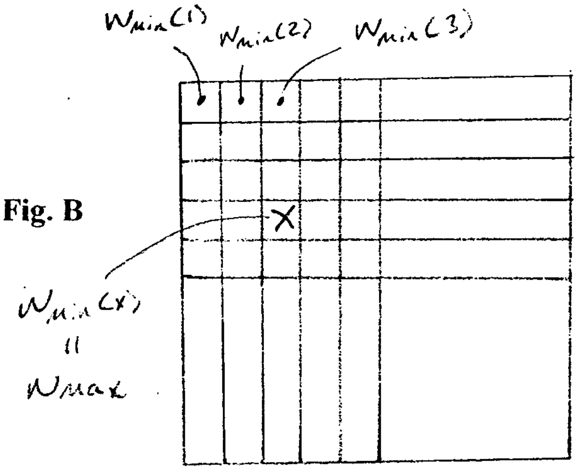
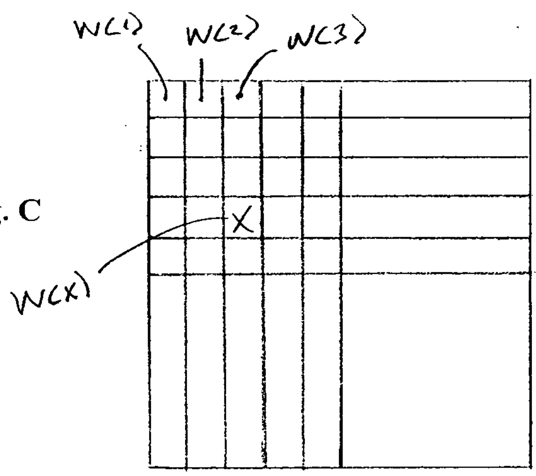
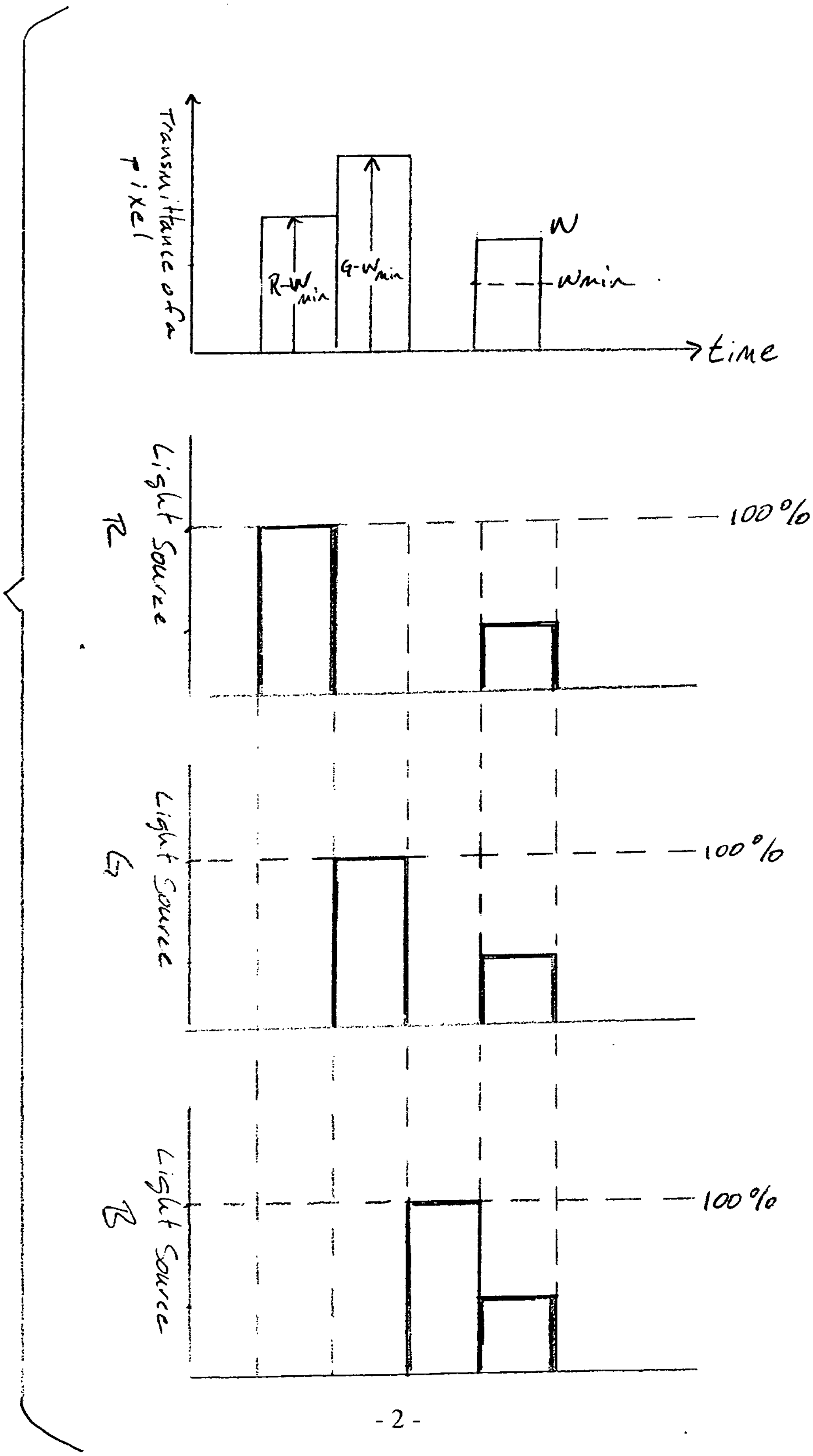


Fig. C





Transmittance of a pixel
R-W min
G-W min
W
Wmin
time
R
Light Source
100%
G
Light Source
100%
B
Light Source
100%

Fig. D